

**State of Alaska**

**Actuarial Audit of  
TRS & PERS**

**October 24, 2002**

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October 24, 2002

Mr. Guy Bell, Director  
Department of Administration  
Division of Retirement and Benefits  
333 Willoughby Ave., 6<sup>th</sup> Floor  
Juneau, AK 99811

**Re: 2002 Actuarial Audit of TRS & PERS**


Dear Mr. Bell:

The enclosed report presents our findings and comments resulting from a detailed review of the actuarial services currently performed by your retained actuary, William M. Mercer, Inc. (Mercer). Milliman USA, Inc. was selected to perform this review following an RFP process completed in June of this year.

Our findings are categorized under two levels of significance to the overall financing of the Systems, and summarized in Section 1. More detailed commentary on our review process and suggested considerations for adjustments to actuarial assumptions or procedures are included in subsequent sections of this report.

We wish to express our appreciation for the cooperation provided to us by the Mercer consultants, you and your staff. We look forward to discussing our report with you and the two Boards of Trustees on October 24, 2002.

Sincerely,



Mark O. Johnson, F.S.A.  
Consulting Actuary

# Alaska Division of Retirement and Benefits

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# **Alaska Division of Retirement and Benefits**

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### **Section 1**

#### **Summary of Recommendations**

##### ***Purpose and Scope of the Actuarial Audit Review***

The purpose of an actuarial audit is to review the work performed by the Systems' actuary to assure the actuarial condition of each System is accurately measured, and that the contribution rate, together with the current assets, is sufficient to provide the benefits promised to members. You need to have an opinion regarding the accuracy and reasonableness of the following:

- The reasonableness, consistency and accuracy of the method, factors, and assumptions used in the actuarial valuations,
- The reasonableness, consistency and accuracy of the compilation of the actuarial valuation, and
- The reasonableness, consistency and accuracy of the results and the actuarial assumptions generated from the experience study.

Our specific methodology for the actuarial audit services requested was discussed in our proposal. We have followed all of the steps outlined in the proposal

Performing an actuarial audit is similar to doing detective work. The auditing actuary is presented with a set of facts, the "clues", and then tries to reconstruct the past events based on the available data. The auditing actuary's information is never as complete or detailed as that available to the retained actuary. Nevertheless, the purpose of the audit is to have the auditing actuary acquire a certain level of confidence that the findings and the results of the retained actuary's work are reasonable and were performed according to generally accepted actuarial standards and principles.

##### ***Outstanding Issues***

Over the next month, we will complete the following tasks:

- Review the individual employer rate calculations,
- Validate the accounting disclosures, and
- Suggest areas for improvements in the reporting of the findings.

We will be available, as requested, to answer questions about our reviews and provide additional comments as warranted.

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### *Statement of Key Findings*

Based upon a thorough review of the 2000 experience studies and the 2001 actuarial valuation reports, including the underlying data and calculations, we found the actuarial work to be generally reasonable. The valuations were performed in accordance with generally accepted actuarial standards and principles. However, we found a number of areas where changes are needed, and have additional observations and recommendations for improving the actuarial process.

This report includes a detailed discussion of all the elements of our review. The major issues are categorized under two levels of significance to the overall funding status of the Systems.

**Level A**      Areas where changes are needed which will result in a financial impact on the actuarial findings. Because we did not perform a replication audit, we will only be able to offer a “broad-brush” directional analysis of the fiscal impact our findings.

**Level B**      Areas where we recommend changes based on our professional opinions or preferences.

These issues are outlined on the following pages. Our observations and recommendations are discussed in later sections of the report in more detail.

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### **Level A Findings**

Areas where changes are needed which will result in a financial impact on the actuarial findings:

1. TRS: Salary data was collected for the year ending on the valuation date and was used without escalation in the first projected year after the valuation. The Actuarial Liability for active member pensions is understated by one-year's wage growth and merit salary scale.  
*(understated liabilities)*
2. PERS: Salary data was collected for the six-month period ending on the valuation date and was used without escalation in the first projected year after the valuation. The Actuarial Liability for active member pensions is understated by one-half-year's wage growth and merit salary scale.  
*(understated liabilities)*
3. TRS: The salaries for part-time members are not converted to the equivalent full-time rate to project retirement benefits.  
*(understated liabilities)*
4. TRS & PERS: The projected death benefits are calculated without the application of the joint & survivor factors.  
*(overstated liabilities)*
5. TRS & PERS: The projected disability benefits for currently active members do not include service beyond the normal retirement age.  
*(understated liabilities)*
6. PERS: P&F occupational disabilities are always projected at 66.67% of compensation.  
*(overstated liabilities)*
7. PERS: Alaska COLA is assumed to be payable to 71% of retired members for some valuation calculations, even though the last experience study reduced this assumption to 68% of retired members.  
*(overstated liabilities)*

We have discussed all of these technical issues with Mercer and they have indicated their concurrence with our findings. We understand Mercer is currently working on the fiscal impact of making the appropriate changes.

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#### ***Level B Findings***

Areas where we recommend changes based on our professional opinions or preferences:

8. TRS & PERS: We believe the entire set of methods should be reviewed as a package. A number of the methods in use are unusual and may not, under certain conditions, provide the level of conservatism or stability the Boards desire. We have alternative suggestions to consider for the actuarial cost method, the amortization strategies, and the asset valuation method.
9. TRS & PERS: We recommend the assumption for future medical cost increases be reviewed prior to every valuation. In addition, we recommend the starting point for future projections be pegged to the latest known blended premium rather than an adjusted previous level.
10. TRS & PERS: We recommend the merit salary scale be reviewed carefully with consideration for a graded schedule with higher increases in the early years of employment.
11. TRS: The valuation assumes one simplified set of early retirement reduction factors to predict early retirement benefits. We recommend that the actual factors be used in the valuation.
12. TRS & PERS: The valuation assumes the resident COLA is applied to the entire benefit, rather than only to the basic benefit.
13. PERS: The valuation determines which tier the active member belongs to. We recommend the Systems provide Mercer with a data code, if possible, that indicates each non-retired member's tier.
14. TRS & PERS: The census data provides insufficient detail for the actuary to accurately predict future retirement benefits for vested terminated members. We recommend that Mercer work with the Systems to develop an accrued benefit or improved information on pay and service histories.
15. The observation period for the Experience Studies should be at least four years, rather than the two-year period used in the latest studies.
16. The Experience Studies and the Actuarial Valuations should provide more depth of information. We will provide detailed suggestions in a later report.



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### Section 2

#### Actuarial Cost Method

##### *Audit Conclusions*

The actuarial cost method used is acceptable and meets generally accepted actuarial standards. However, the overall funding mechanism for TRS and PERS is unusual and includes elements that do not consistently reflect a cohesive funding policy. We recommend that the entire set of methods be reviewed as a package.

##### *Actuarial Cost Method*

The cost method used by Mercer is the Projected Unit Credit (PUC) method. The standard PUC method spreads the cost of benefits over each individual's working lifetime as service is accrued. The major components of the method are described below.

- **Normal Cost:** The cost allocated to the current year is called the Normal Cost. Under this method, the Normal Cost is equal to the present value of benefits expected to be paid in the future with respect to the service earned in the year subsequent to the valuation date.
- **Actuarial Liability (AL):** The Actuarial Liability, sometimes referred to as the Accrued Liability, is equal to the present value of all benefits expected to be paid in the future with respect to service performed up to the valuation date.
- **Unfunded Actuarial Liability (UAL):** Once the Actuarial Liability is determined, the Unfunded Actuarial Liability (UAL) is determined by subtracting the Actuarial Value of Assets. If the Actuarial Value of Assets exceeds the AL on the valuation date, the UAL is negative and the system has an Actuarial Surplus. The UAL (whether the system is in an unfunded or surplus position) is amortized over a rolling 25-year period by contributions in addition to (or as a credit against) the Normal Cost.

In our opinion, the basic funding method used by Mercer as described above is a well-recognized and generally reasonable method. However, from our perspective, this method can produce rising Normal Costs under certain emerging demographic circumstances. For instance, if the active population is aging, the Normal Cost expressed as a percentage of payroll may increase. The active membership may have an increasing attained age if the new entrants are hired at older ages than in the past, which is a real possibility with today's population.



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The Survey of State and Local Government Employee Retirement Systems, published by the Government Finance Officers' Association Research Center, is a broad based and well-recognized source of information about public employee retirement systems. The latest survey shows the following breakdown of actuarial cost methods used by public retirement systems. Note at the time of this survey that the PUC method was the second most popular method, but only used by 11% of the reporting systems.

<i>Table 1</i>	
Actuarial Cost Method	Percent of Total
Entry Age	75%
Projected Unit Credit	11
Aggregate	10
Other	<u>4</u>
All Reporting Systems	100%

We believe the Entry Age method is the most popular actuarial cost method for public sector retirement systems because it does a superior job of producing stable contributions as a percentage of an increasing payroll. From a budgetary standpoint, many systems are looking for contribution rate stability.

It is difficult to determine from the published actuarial reports what impact the average attained age has had on the TRS and PERS liabilities because of improvements to the data over the past several years. Nevertheless, we believe it is true that, if all other experience follows the actuarial assumptions, the Normal Costs of TRS and PERS will tend to increase over time if the average age of the active members increases over time. There is evidence that the average age of public employees across the country has been increasing as the age of the available workforce has increased.

We recommend that Mercer periodically monitor the Normal Cost as a percentage of salaries and determine if costs are expected to increase in the future. One way to measure this is to calculate the Normal Cost Rate using the Entry Age actuarial cost method and compare it to the current Normal Cost Rate under the PUC method.

#### ***Target Funding Ratio***

One aspect of the funding policy for PERS is referred to as the 102% Target Funding Ratio. This adds a level of conservatism to the determination of the average contribution rate. A projection valuation is used to ascertain several factors that are used to adjust the current Actuarial Liability. The end result is a Past Service Rate that includes a margin for conservatism. Although the concept is laudable, the documentation of the

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calculation should be more complete. It is a challenge to understand the mechanics of the adjustment. We did not validate these calculations.

#### ***Amortization***

There are two elements of the cost method that require the calculation of an amortization payment or credit: the Past Service Rate and the Contribution Rate Adjustment.

**Past Service Rate:** The Target Unfunded Liability is amortized as a fixed dollar amount over a rolling 25-year period. That is, the amortization payment is recalculated every year based on a new 25-year schedule. Since the amortization payment is recalculated every year, the method is not intended to fully amortize the Unfunded Liability.

In column (A) of the following Table 2, we have demonstrated how an Unfunded Liability would be amortized under this method. Notice that, if the experience follows all of the actuarial assumptions for the entire period, less than 30% of the UL is amortized after 25 years (\$718 remains from a \$1,000 UL). Also note in column (D) that the Amortization Rate, or Past Service Rate, declines as a percentage of the increasing payroll.

One rationale for using this amortization method is that there is an expectation that future actuarial gains will offset the current UL, or if there is a Surplus, that future actuarial losses will offset the current Surplus. This is not unreasonable and, in fact, it is permissible under the rules of the Governmental Accounting Standards Board (GASB). However, because the method is so slow to reduce the current balance, and the typically volatile investment gains and losses are handled separately, we support a change.

In column (B) we have changed the amortization from a rolling 25-year period to a fixed 25-year period. You can see that at the end of the period, the entire UL is amortized. The fixed dollar amortization payment in this example is \$88 per year, which is shown in column (E) as a decreasing percentage of the increasing payroll. This is a relatively conservative approach to amortizing the UL over the 25-year period because the payments are higher in the earlier years as a percentage of salaries.

The third approach is to calculate the amortization payment such that it remains a level percentage of salaries over the 25 years. Column (F) shows an amortization rate of 0.65% of salaries every year. As you can see in column (C), the UL balance actually increases for seven years then starts to decline, passing the \$1,000 mark after 14 years. The amortization accelerates more rapidly in the later years as the 0.65% amortization rate is applied to the increasing payroll.

The Boards should consider a fixed amortization period if the primary goal is to be conservative when there is a UL, or a fixed period and level rate if the desire is to produce contribution rate stability.

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**Table 2**

Year	Expected Remaining UL			Amortization Rate		
	Rolling Dollar	Fixed Dollar	Fixed Percent	Rolling Dollar	Fixed Dollar	Fixed Percent
	(A)	(B)	(C)	(D)	(E)	(F)
1	\$ 987	\$ 987	\$1,015	0.88%	0.88%	0.65%
2	974	973	1,029	0.84%	0.85%	0.65%
3	961	957	1,041	0.80%	0.82%	0.65%
4	948	940	1,052	0.76%	0.79%	0.65%
5	936	922	1,060	0.72%	0.76%	0.65%
6	923	903	1,066	0.68%	0.73%	0.65%
7	911	881	1,069	0.65%	0.70%	0.65%
8	899	858	1,068	0.61%	0.67%	0.65%
9	887	834	1,065	0.58%	0.65%	0.65%
10	876	807	1,057	0.55%	0.62%	0.65%
11	864	778	1,045	0.52%	0.60%	0.65%
12	853	746	1,027	0.50%	0.57%	0.65%
13	841	712	1,004	0.47%	0.55%	0.65%
14	830	675	976	0.45%	0.53%	0.65%
15	819	635	940	0.42%	0.51%	0.65%
16	809	592	896	0.40%	0.49%	0.65%
17	798	545	844	0.38%	0.47%	0.65%
18	787	494	783	0.36%	0.45%	0.65%
19	777	439	712	0.34%	0.44%	0.65%
20	767	380	629	0.33%	0.42%	0.65%
21	757	315	533	0.31%	0.40%	0.65%
22	747	245	424	0.29%	0.39%	0.65%
23	737	170	300	0.28%	0.37%	0.65%
24	727	88	159	0.26%	0.36%	0.65%
25	718	0	0	0.25%	0.34%	0.65%

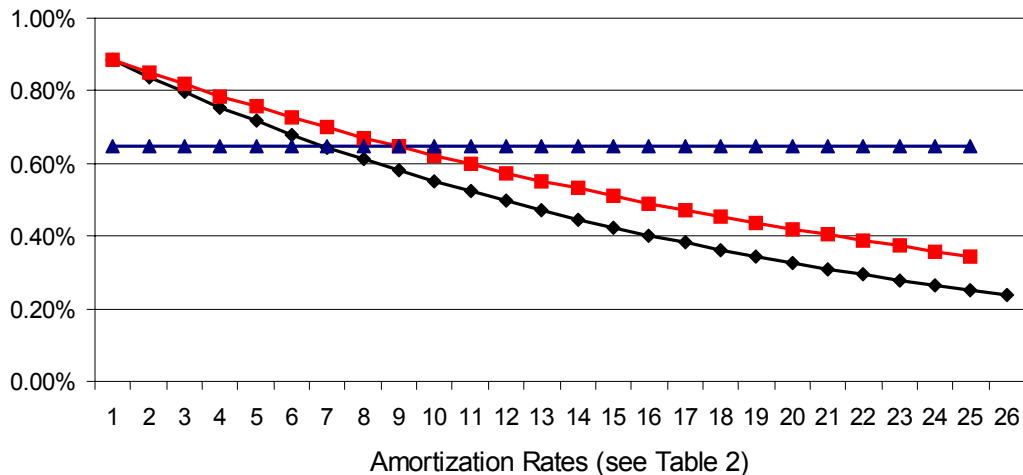
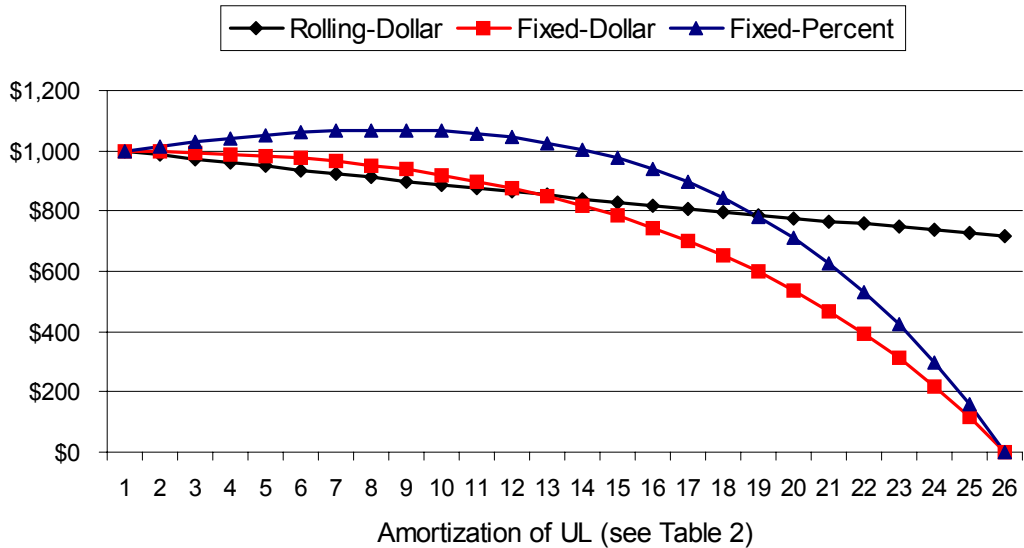
**Assumptions:**

Beginning Salaries: \$10,000  
Beginning UL: \$1,000 (10% of Total Salaries)  
Salary Increases: 4.00% per year  
Discount Rate: 8.25% per year  
Population Growth: 0.00% per year

The charts on the next page depict the declining balances of the UL under these three methods, and the amortization contributions as a percentage of payroll.



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**Contribution Rate Adjustment:** The asset smoothing method, discussed in the next section, includes the amortization of any outstanding balance of previously deferred amounts outside the 5% market value corridor. The amortization of this amount is calculated under a completely different method than the Past Service Rate.

The net deferred amount outside the corridor is amortized as a 20-year payment or credit calculated as a level percentage of salaries increasing with inflation and a 1% per

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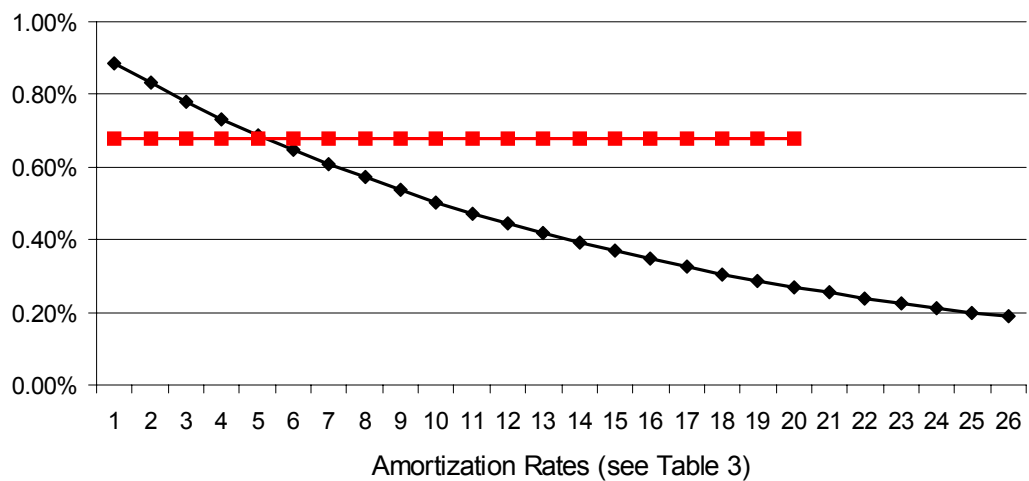
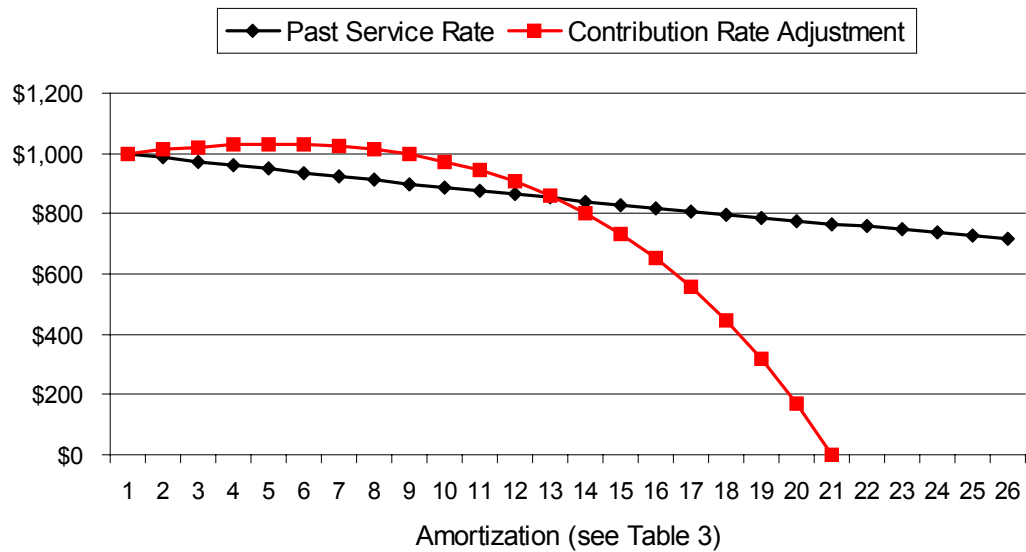
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year growth the active membership. Table 3 compares this amortization method with the amortization of the Past Service Rate.

<i>Table 3</i>				
Year	Expected Remaining UL		Percent of Salary Amortization Rate	
	PSR (A)	Assets (B)	PSR (C)	Assets (D)
1	\$ 987	\$1,012	0.88%	0.68%
2	974	1,021	0.83%	0.68%
3	961	1,027	0.78%	0.68%
4	948	1,030	0.73%	0.68%
5	936	1,029	0.69%	0.68%
6	923	1,024	0.65%	0.68%
7	911	1,013	0.61%	0.68%
8	899	997	0.57%	0.68%
9	887	974	0.54%	0.68%
10	876	944	0.50%	0.68%
11	864	906	0.47%	0.68%
12	853	859	0.44%	0.68%
13	841	801	0.42%	0.68%
14	830	733	0.39%	0.68%
15	819	652	0.37%	0.68%
16	809	556	0.35%	0.68%
17	798	446	0.33%	0.68%
18	787	318	0.31%	0.68%
19	777	170	0.29%	0.68%
20	767	0	0.27%	0.68%
21	757	0	0.25%	0.00%
22	747	0	0.24%	0.00%
23	737	0	0.22%	0.00%
24	727	0	0.21%	0.00%
25	718	0	0.20%	0.00%
<b>Assumptions:</b>				
Beginning Salaries:		\$10,000		
Beginning UL:		\$1,000 (10% of Total Salaries)		
Salary Increases:		4.00% per year		
Discount Rate:		8.25% per year		
Population Growth:		1.00% per year		



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Because the two amortization methods are so dissimilar, we recommend that Mercer review the amortization policies to ensure the Boards' goals are being met.

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### ***Governmental Accounting Standards Board***

Mercer states the assumptions and methods used for funding purposes and for the disclosures presented in this report satisfy the parameter requirements set forth under the Governmental Accounting Standards Board (GASB) Statement No. 25.

The contribution rates developed in the valuations include an amortization schedule using a projected membership population. GASB No. 25 is very specific that if the amortization of an Unfunded Liability is amortized as a level percentage of payroll, the assumed payroll growth should not include an assumed increase in the number of active plan members.

The recommended contributions for TRS and PERS do not comply with the parameters permitted for the calculation of the Annual Required Contribution (ARC) under GASB disclosure Statement No. 25. Therefore, a separate calculation for GASB No. 25 is required. Those calculations were not shown in the valuation reports. We will be reviewing the GASB calculations in the next phase of the audit.



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### **Section 3**

#### **Asset Valuation Method**

##### ***Audit Conclusion***

The underlying actuarial asset valuation method is fairly common, however, it contains several features that make it unusual. The corridor is narrow and the calculation and amortization of deferred investment gains and losses is complicated and not well documented in the valuation reports.

##### ***Basic Method***

From an investment standpoint, the current fair value of assets is usually accepted as the true measure of the asset value. However, using fair value can lead to unstable measures of the funding status of a system due to temporary changes in the markets. Actuarial asset valuation methods smooth out temporary aberrations in the fair value of assets, thus minimizing such instability.

An effective asset valuation method would:

- Produce values for the total fund that are relatively stable from year to year to avoid undue increases and decreases in the resulting funding requirements. The method should offset any temporary fluctuations in the market.
- Produce realistic values that are also acceptable to others. This would include consideration of accounting requirements, actuarial standards, and the expectation of a system's staff and membership. The actuarial standards of practice expect the actuarial valuation of assets to generally reflect some function of fair value.
- Be easily understood by others and not be unduly difficult either to explain or to calculate.
- Be independent of the rate of asset turnover. Although the method should be consistent with the funding policy of the system, it should not directly influence investment decisions nor should investment decisions directly influence the asset valuation method.
- The method should be consistent with the system's funding policy.





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The basic method used by Mercer conforms to the criteria shown above. However, there are two elements that we recommend be reviewed.

**Corridor:** The 5% corridor is very narrow relative to typical asset smoothing methods. A corridor of 20% is likely the most common, with some systems using a corridor as small as 10% and some not using a corridor at all.

**Recognition of Deferred Gains and Losses:** Generally, the deferred gains or losses are recognized over a period of three to five years. Once recognized, they become part of the Actuarial Value of Assets used to determine the Unfunded Liability. Once part of the Unfunded Liability, amortization proceeds in accordance with the funding policy. Both TRS and PERS have separate amortization policies for the recognition of previously deferred gains or losses.

A separately measured amortization of investment gains and losses is acceptable, however as mentioned in the previous section, the amortization is dissimilar to the amortization of gains or losses arising from the Actuarial Liability. As a result, the determination of the Actuarial Value of Assets and the Contribution Rate Adjustment are both relatively confusing.

The specific derivation of the Actuarial Value of Assets and the Contribution Rate Adjustment are not sufficiently documented in the valuation reports.



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### **Section 4**

#### **Actuarial Assumptions**

##### ***Audit Conclusion***

We reviewed all of the key actuarial assumptions and believe the assumptions recommended by Mercer are reasonable and appropriate with only a few exceptions: medical costs and merit salary increases.

##### ***Comments***

The most recent experience studies were for the two-year period ending June 30, 1999, and are referred to as the 2000 Studies. Since the 2000 Studies were completed, two Actuarial Standards of Practice have been published which should encourage Mercer to provide more documentation of their findings in the future.

Our recommendations for changes in the assumptions are based on our actuarial judgment and experience with other public retirement systems, as well as a review of the underlying data for Mercer's 2000 Studies. A recommendation of change in an assumption does not necessarily indicate that those currently used are inappropriate.

In reviewing the assumptions currently used by Mercer, we are guided by the Actuarial Standards Board (ASB) Actuarial Standards of Practice No. 4, No. 27, and No. 35. The actuary is required by the standards to consider the reasonableness of each actuarial assumption independently on the basis of its own merits, of its consistency with each other assumption, and of the degree of uncertainty and potential for future fluctuations. Although a set of assumptions in the aggregate may appear to reflect the System's experience, failing to isolate the individual assumptions can lead to inappropriate results when a particular aspect of the plan or a change in the plan is under review.



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### *Economic Assumptions*

In our opinion, based on the information and economic environment present in 2000, the economic assumptions recommended by Mercer were generally reasonable.

The Actuarial Standards Board has adopted Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans. The 2000 Study presents evidence that the recommendations were developed in accordance with the applicable Actuarial Standards of Practice.

Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience.

Recognizing that there is not one “right answer”, the standard calls for the actuary to develop a best estimate range for each economic assumption, and then recommend a specific point within that range. Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period. The economic assumptions are much more subjective in nature than the demographic assumptions. The 2000 Studies recommended the following revisions to the economic assumptions:

<b>Table 4</b>		
<b>Assumption</b>	<b>Prior Assumption</b>	<b>Revised Assumption</b>
Inflation	4.00%	3.50%
Real Investment Return	<u>4.25</u>	<u>4.75</u>
Total Return	8.25%	8.25%
Inflation	4.00%	3.50%
Real Wage Growth	<u>0.50</u>	<u>0.50</u> *
Total Wage Growth	4.50%	4.00%
* 1.00% for P&F in PERS		

These changes are representative of the recognition that future inflation is not expected to be as high as was previously assumed, based on historical data. We have seen

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similar decreases in both the price inflation and wage inflation assumptions in other public sector plans.

At the same time, the investment return assumption has remained constant. This means that a greater net real rate of return is now expected from the portfolio. We believe this assumption was supportable in 2000.

The Board should be aware that the Actuarial Liability is directly impacted by these two important assumptions. First, the present values are highly sensitive to the “spread”, which is the effective discount factor in determining the present value of benefits to active members. Secondly, the present value of benefits for retired members is impacted by the investment return assumption. The changes mean there has been a 0.50% per year increase in this spread (except for PERS P&F members). The change had the impact of lowering the Actuarial Liability for active members.

The current package of economic assumptions is reasonable, but more aggressive than the previous assumptions. Since economic assumptions are subjective in nature, it is our recommendation that the Board be fully comfortable with the implications of the assumptions. There is an “actuarial risk” associated with the economic assumptions the same as there is an investment risk associated with a given portfolio mix. The assumptions do not affect the actual long-term cost of a plan. The ultimate cost will emerge in accordance with the benefits and expenses that are actually paid.

**Inflation:** The inflation assumption is used in the valuation to build the assumptions for investment return and wage growth. To test the reasonableness of the 3.50% inflation assumption as of 2000, we used economic statistics that have been accumulated on a monthly basis from 1926 through 1999 and published by the Society of Actuaries. The data for inflation is based on the national Consumer Price Index, US City Average, All Urban Consumers (CPI-U). The data shows a compounded annual inflation rate for the period from 1926 through 1999 of 3.1%.

Since the Treasury Department started issuing inflation indexed bonds, it is possible to determine the approximate rate of inflation anticipated by investors by comparing the yields on inflation indexed bonds with traditional fixed government bonds. Market prices in 1999 suggested investors expected inflation to average about 2% over the ensuing five to ten years.

Most economists forecast inflation increases at lower levels than Mercer’s current assumption of 3.5%, but are looking at shorter periods than appropriate for a pension plan. To find an economic forecast with a sufficiently long time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In a recent Trustees report, the annual increase in the CPI over the next 30 years under the intermediate cost assumptions was 3.0% and the reasonable range presented was 2.0% to 4.0%.

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Although we believe inflation levels may turn out to be lower than currently assumed, we believe the 3.50% inflation assumption is reasonable. We concur with Mercer that a separate inflation assumption for the Post Retirement Pension Adjustments (PRPA) is not justified.

**Wage Growth:** Estimates of future salaries are based on two types of assumptions. Rates of increase in the general wage level of the membership are directly related to inflation, while rates of increase in individual salaries due to merit or promotion and longevity occur even in the absence of inflation.

The excess of wage growth over price inflation represents the increase in the standard of living, also called real wage growth. The 2000 Study contained a recommendation for productivity increases of 0.50% per year, except for the PERS P&F group, where the recommended increase is 1.00%.

Although we generally agree with the level of real wage growth increase in TRS and PERS, in our opinion, the reports should have demonstrated a basis for the real wage growth increases. In addition, it is uncommon to assume a different real wage growth, an assumption derived for the forecast of a general economic trend, for different groups within the same valuation. Increases in excess of across-the-board adjustments are normally handled in the longevity assumption.

We have used statistics from the Social Security System on the National Average Wage from 1951 through 1998 (these would have been available for the 2000 Study). For years prior to 1951 we studied the Total Private Nonagricultural Wages as published in Historical Statistics of the U.S., Colonial Times to 1970. This data shows a compounded annual increase from 1926 through 1998 of 4.6%.

Inflation for the same period was 3.1%, so the long-term real increase in wages has been about 1.5% per year. The difference between the compounded rate of wage increase and the rate of inflation has been decreasing.

Based on our judgment, we believe that a range between 0.25% and 1.00% is reasonable for the long-term real wage growth assumption. Therefore, based on an inflation assumption of 3.50%, we believe a reasonable range for wage growth is between 3.75% and 4.50%. The Mercer assumption fits within this range.

**Investment Return:** The investment return assumption is one of the primary determinants to allocate the expected cost of the Systems' benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. The current assumption for investment return is 8.25% per year. We believe this is a reasonable assumption given the Systems' current asset allocation policies.

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The following description of the derivation of the 8.25% assumption contained in the 2000 Study followed the actuarial standard.

<b>Table 5</b>			
<b>Asset Class</b>	<b>Expected Real Rate of Return</b>	<b>Policy Asset Allocation</b>	<b>Return by Class</b>
Domestic Large Cap Equities	6.61%	29%	1.92%
Domestic Small Cap Equities	7.39	12	0.89
International Equities	6.81	17	1.16
Domestic Fixed Income	3.00	30	0.90
International Fixed Income	3.51	5	0.18
Real Estate	4.83	<u>7</u>	<u>0.34</u>
Total Fund		100%	5.39%

*“Considering that the actual year-by-year returns achieved by PERS will be volatile, reflecting the risk associated with each asset class, it is often prudent to set the real return assumption below the full expectation. We believe a real return assumption between 4.50% and 5.00% would be appropriate, and when added to the long-term inflation assumption of 3.5% yields a nominal return of 8.00% to 8.50%. We are recommending that the Board continue to assume 8.25% for the interest rate.”* (from Mercer’s experience study report)

Our following demonstration also shows that the 8.25% assumption was within a reasonable range in 2000. A formula-based model was used to predict future returns based on these capital market assumptions, the asset allocation policy, and assumed annual rebalancing. The asset allocation and the expected real returns and total returns by asset class are shown below.

Table 6				
Asset Class		Expected Real Rate of Return	Standard Deviation	
US Equities		6.80%	18.10%	
International Equities		6.90	19.20	
Real Estate		5.70	15.50	
Fixed Income		4.50	3.10	
Cross Correlation Matrix				
Asset Class	US Equity	Intl Equity	Real Estate	Fixed
US Equities	1.00			
Int'l Equities	0.58	1.00		
Real Estate	0.36	0.29	1.00	
Fixed Income	0.27	0.24	0.48	1.00

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These capital market assumptions were combined with the asset allocation policy shown in the 2000 Study to generate expected returns over a thirty-year period. The model assumes that investment returns are normally distributed and are based on mathematical formulas from *The Long-Term Expected Rate of Return: Setting it Right* by Olivier de la Grandville as published in the Financial Analysts Journal, Nov/Dec 1998.

The expected real rate of return of a portfolio allocated in this way is 5.94% for one year, which is slightly higher than the Mercer results shown in the 2000 Study. However, the return is subject to significant volatility. The model provides a guide to see if it is reasonable to expect this return to compound over longer periods of time. The results are summarized in the following table.

Table 7							
Horizon in Years	Mean	Std Dev	Percentile Results				
			5th	25th	50th	75th	95th
1	5.94%	10.5%	(10.5)%	(1.4)%	5.4%	12.7%	24.1%
10	5.47	3.3	0.1	3.2	5.4	7.7	11.0
20	5.44	2.3	1.6	3.8	5.4	7.0	9.3
30	5.43	1.9	2.3	<b>4.1</b>	<b>5.4</b>	<b>6.7</b>	8.6

In the first year, the mean real return is 5.94%, but due to the volatility associated with the asset allocation, the range of probable outcomes is quite large. For example, for a single year there is a 5% chance the return will be less than -10.5% and a 5% chance it will be greater than 24.1% based on these capital market assumptions. As the time horizon lengthens, the range of cumulative average results narrows.

Over a thirty-year time horizon, there is a 25% chance the real return will be less than 4.1% and a 25% chance the return will be greater than 6.7% (bold numbers on the bottom line in the table above). Therefore, we can say the real return is just as likely to be within the range from 4.1% to 6.7% as not. The median return over thirty years is expected to be 5.4%.

The investment return is assumed to be net of all investment-related and administrative expenses. The investment and administrative expenses, taken from the System's financial statements, are very modest. The expense ratio is calculated as the total expenses divided by the average asset balance during the year. Based on this data, it appears the annual investment and administrative expenses represent about 0.3% of the Systems' assets.

Based on the ASOP No. 27 guidelines, we conclude that a reasonable range for the net investment return is from 7.3% to 9.9%.

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<i>Table 8</i>			
Components of Return	<u>Percentile Results</u>		
	25th	50th	75th
Real Investment Return	4.1%	5.4%	6.7%
Inflation	3.5	3.5	3.5
Assumed Expenses	<u>(0.3)</u>	<u>(0.3)</u>	<u>(0.3)</u>
Net Investment Return	7.3%	8.6%	9.9%

Based on this analysis, we concur that the net investment return assumption of 8.25% per year was reasonable based on available information and the economic environment in 2000. We believe an investment return assumption of 8.25% per year was consistent with the level of inflation and real rate of return likely to occur over an extended period of time, net of expenses.

Although comparing one system's assumptions to those of other systems has only limited importance in setting assumption, we did make several comparisons.

- The assumption of 8.25% was slightly high when compared with the assumptions made by other public systems at that time. The 2000 GFOA survey of state and local governmental employee retirement systems showed that the average assumed rate of return from the latest available actuarial reports was 7.88% for all systems.
- The biennial comparative study performed by the State of Wisconsin on 84 statewide systems showed a range from 7.0% through 9.0%, with an average of 8.0%. The rates of return were fairly well distributed, with over half of the systems using 8.0%, 20% using 7.5% and 20% using 8.5%.



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#### Medical Costs

One of the most critical assumptions in the valuation is the expected increase in medical costs. These costs have historically increased at a higher rate than the CPI. Although this is a difficult assumption to judge in the short term, we believe the current assumption and method should be more conservative. There are several elements of the process we wish to discuss.

**Trend Assumption:** The following table shows the assumption used in the last three valuations for TRS and PERS.

<i>Table 9</i>				
FY	Actuarial Valuation			Actual Increase
	1999	2000	2001	
1999	5.5%	-	-	20%
2000	5.5	8.5%	-	20
2001	5.5	7.5	7.5	15
2002	5.5	6.5	6.5	10
2003	5.5	5.5	5.5	-
2004-08	5.5	5.0	5.0	-
2009-13	5.5	4.5	4.5	-
2014 +	5.5	4.0	4.0	-

The change for the 2000 valuations was an appropriate response to the expectations for medical cost increases. We agree with the approach of starting at a high point and grading down to a level slightly higher than the long-term inflation assumption. Since the inflation assumption is 3.5%, it is appropriate for the ultimate assumption to be 4.0%.

We recommend that this assumption be reviewed prior to every valuation until such time as medical costs have stabilized close to the rate of price inflation. In our opinion, the 2001 valuations should not have simply moved one year down the schedule without a thorough review.

We believe the current assumption should be strengthened. Our healthcare actuaries would have recommended the assumption start within a range of 9% to 11% in 2001 with a gradual decline to about 5% (approximately the assumed level of price inflation plus the expected real rate of growth in the economy).

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**Valuation Premium:** The Mercer method is designed to enhance stability. We believe stability should be introduced through the amortization of liabilities rather than through the technique being used. Given the recent history of medical cost increases, the Mercer method can significantly understate liabilities if the actual increases are greater than the assumed increases.

Mercer anchored the blended premium several years ago and has escalated it by the assumed increases. Therefore, the blended premium used in the 2001 valuations was \$577.40 when the actual blended premium was \$668.00. This means the valuations are using a starting point for the projection of future medical costs that is almost 14% lower than the current blended premium. It would take three years for the assumed premium to catch up with the actual premium if there is no medical inflation during that time. This does not appear reasonable to us.

We recommend the valuations always adjust the starting point for future projections based on the latest actual premium levels.

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### *Demographic Assumptions*

Demographic assumptions relate to the probability of an active member leaving the system and the promotional rate component of the salary increase assumption. We reviewed both the current demographic assumptions and the recent changes recommended in the 2000 Studies.

Actuarial Standard of Practice (ASOP) No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries giving advice on selecting demographic assumptions for defined benefit plans, such as TRS and PERS. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

Studies of demographic experience involve several steps.

- First, the number of members changing membership status, called decrements, during the study are tabulated by age, duration, sex and class of membership.
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called the exposure, by the expected rates of decrement.
- Then, rates of decrement are calculated based on the actual results and compared with the current assumption.
- Finally, proposed new rates of decrement are developed based on the judgment of the actuary.
- Typically, the number of actual decrements is compared with the number of expected decrements by using the actual to expected ratio (A/E Ratio). This is a helpful tool to see how close the actual experience was to the assumption.

If the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements or rates of decrement, by age, sex, or duration does not follow the expected pattern, new assumptions are considered. Recommended revisions normally are not an exact representation of the experience during the observation period. Judgment is required to predict future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent observation periods.

The most recent experience study was for the two-year period ending June 30, 1999, and is referred to as the 2000 Studies. This is a very short observation period, particularly for systems as small as TRS and PERS. We recommend that the next studies use observed data from a period at least four years long. The advantage of a very short observation period, such as two years, is that the actuary can isolate a recent

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trend by comparing the results to previous study periods. However, the danger of looking at such a short observation period is that the actuary may be swayed by anomalies in the data or trend that will not emerge as a good representation of future experience.

**Retired Member Mortality:** This is an obviously critical assumption for appropriately calculating the liability for all retirees and beneficiaries. Given recent improvements in longevity, a margin is usually set to allow for additional improvements. This assumption is used to value not only benefits payable to the current retired members but also in projecting the value of future benefit payments to active members many years ahead. Thus, the extra margin is needed to assure that the liabilities for benefits for future retirees are adequate.

The life expectancies of current and future retirees are predicated on the assumed rates of mortality at each age. It is commonly known that rates of mortality have been declining throughout the last century, which means people, in general, are living longer.

Because of clear differences in mortality rates, healthy retirees and disabled retirees are usually studied separately. Disabled mortality was not studied separately for TRS and PERS, but this is acceptable since the number of disabled retirees is relatively small.

Typically we see a compilation of the actual deaths compared to the number of expected deaths in the observation period. Even for a relatively small group, this analysis will prove helpful. If the A/E Ratio is greater than 100%, fewer deaths were predicted than actually occurred, and there is some margin for future mortality improvements. Consider the sample we developed below.

<i>Table 10</i>			
<b>S A M P L E</b>	<b>Actual</b>	<b>Expected</b>	<b>A/E Ratio</b>
Observed Data			
Male	1,000	1,030	97%
Female	<u>1,000</u>	<u>990</u>	101%
Totals	2,000	2,020	99%
Revised Assumptions			
Male	1,000	925	108%
Female	<u>1,000</u>	<u>925</u>	108%
Totals	2,000	1,850	108%

In this illustration, the observed A/E Ratio for male retirees is under 100%, clearly showing that changes are warranted. Even though the A/E Ratio for female retirees is greater than 100%, the actuary may believe that changes are warranted to provide a



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greater margin for future mortality improvements. Once revised mortality assumptions are selected, the A/E Ratios are recalculated. In this illustration, the new A/E Ratios are 108%. In our experience, mortality margins between 5% and 10% are prudent.

We agree that a revision was needed, but without further information, we can't assess the margin included for future mortality improvements. We have two separate points on the mortality assumptions.

- There is clear evidence from the Society of Actuaries that relatively better educated individuals tend to live longer. For this reason, we also find in data from other states that teachers tend to live longer than non-teacher public employees. Note that the mortality assumptions for retirees in TRS and PERS are the same. We recommend that the next experience studies use the approach of compiling and comparing the A/E Ratios to determine the expected mortality margins in the two systems.
- Some systems use a different mortality table to predict the longevity of members who have not yet retired. The theory is that by the time the active members retire, the retired mortality will be improved which will in turn cause the actuary to revise the mortality assumption increasing the Actuarial Liability. By anticipating future retiree mortality improvements for active members, the sudden increase in the Actuarial Liability can be avoided.

**Merit Salary Scale:** The merit scale is based on years of service, and is independent of age and sex. The merit scale is a flat percentage and extends 5 years for TRS and P&F, and 10 years for other members of PERS. In our opinion, the assumptions are not consistent with the observed data. However, the patterns of the observed data are very consistent with the patterns we have seen in other states.

The observed data shows a markedly higher merit increase in the earliest years of membership, followed by a gradual decline over 10 to 20 years.

- **TRS:** Teachers typically have a very well defined salary scale with steps for longevity and additional educational requirements. The observed data is consistent with our expectation. Although we do not have the raw data to manipulate, we envision an assumption that starts at 9% and declines gradually to the 20<sup>th</sup> year.
- **P&F:** The first year or two showed very high increases which would be consistent with a probationary period, typical of many public safety groups. We believe the data shows a different pattern of merit increases out to the 10<sup>th</sup> year.
- **Other Employees in PERS:** This group also shows the higher salary increases in the early years. We believe the observed data may show longevity increases out past the 15<sup>th</sup> year.



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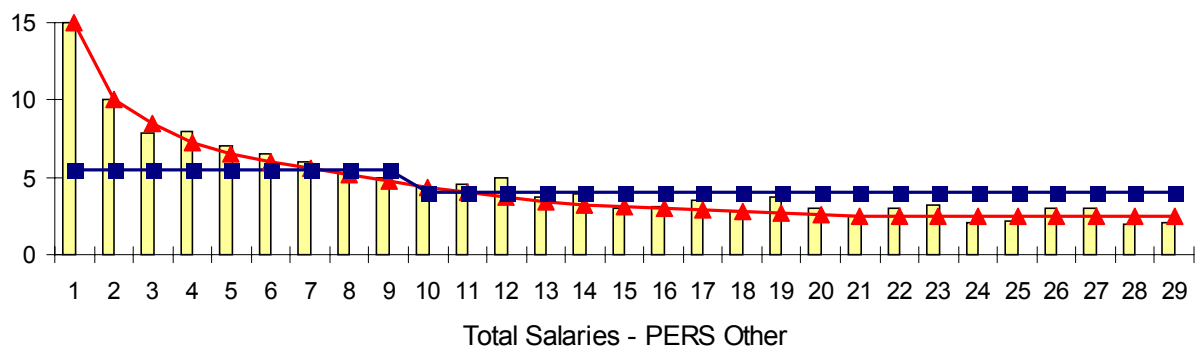
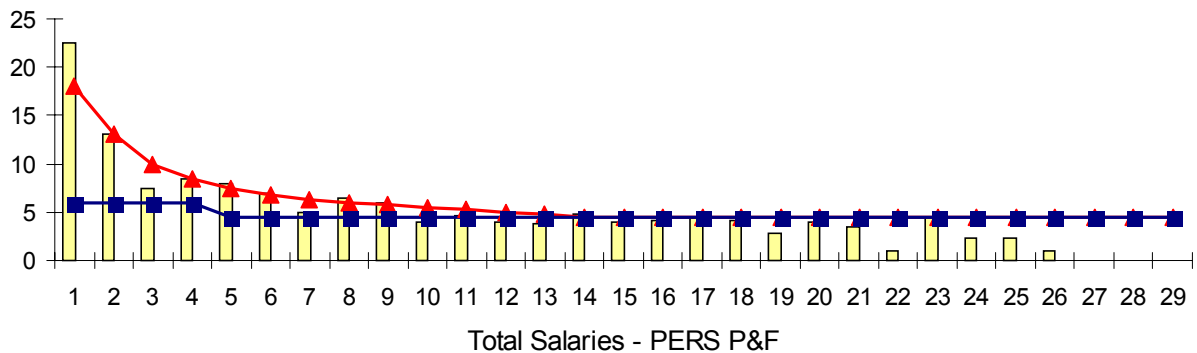
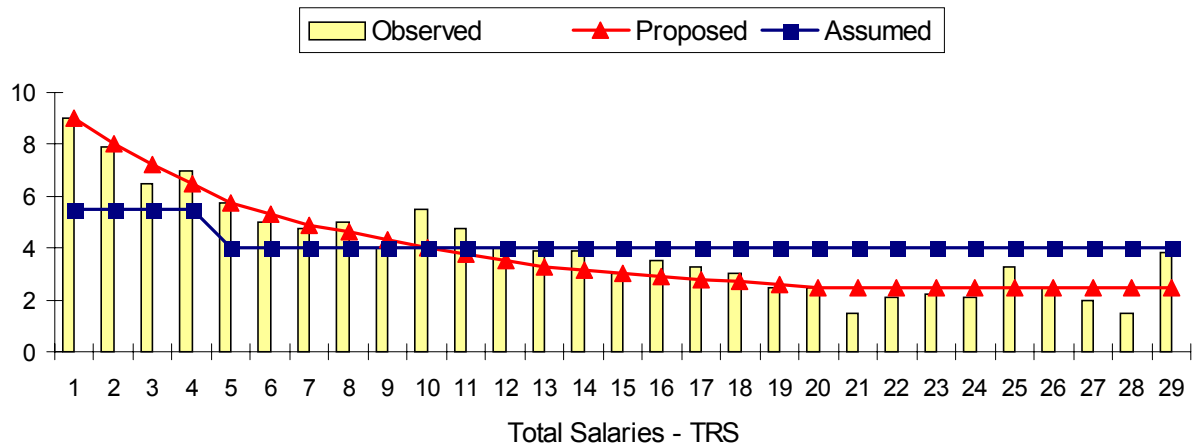
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We have illustrated our observations with a restatement of the graphs from the 2000 Studies (compiled directly from the graphs, not the raw data) and an illustrated proposed set of assumptions. The assumed data is the current assumption used by Mercer.

Note on the following graphs that we have shown the total salary increases, which include inflationary wage growth, if any. The merit increases can only be measured if we know the actual inflationary wage growth for the period. This is usually measured by observing where the total salary increases ultimately level out. Therefore, it is likely that the general wage increases over the observation period were less than the assumed rate, particularly for TRS and the non-P&F PERS members.

Although more study would be needed to arrive at the proper merit increase assumption, the patterns shown as “proposed” on the following graphs may provide a more reliable prediction of future increases.

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### Section 5

#### Valuation Data

##### *Audit Conclusion*

The membership data used by Mercer for the June 30, 2001 actuarial valuations of TRS and PERS is consistent with the data provided by the Systems. Mercer's calculation of accrued benefits for vested terminated employees may be overstating benefits and, as a consequence, the valuations may overstate the vested terminated liabilities.

##### *Comments*

We compared the data supplied by the TRS and PERS with the data summaries presented in the Mercer valuation report. In order to confirm the accuracy and appropriateness of the data processing performed by Mercer, we received original "raw" data supplied TRS and PERS and proceeded to process this data to create valuation data files. These valuation data files were then used as the basis of a series of data summary exhibits created to compare with the data summary exhibits that appear in the Mercer valuation report.

The Systems provided the following files that served as the basis of our analysis:

- a "master" file containing one record for each active or deferred member in the plan along with necessary demographic data fields,
- a file containing salary and service by year for each active or deferred member in the System,
- a file containing additional claimed service that was not included in the previous two files (TRS only)
- a primary retiree data file derived from the payroll run for all retirees at the end of July, 2001, including the most recent PRPA's.

**Member Count:** The first step in our verification process was to confirm that the correct number of records were being used. For the active, vested terminated, and retired groups we were able to do this in a precise manner since individual records with unique identifiers were available in the data files supplied by the Systems. Based on our understanding of the data, we constructed a data set that we believe to be an accurate representation of the plan population on June 30, 2001. After summarizing this data set we compared participant counts by participant status (active, vested terminated, retired) to those counts presented in the Mercer valuation report. In summary, for each



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participant status we were able to match the respective participant count that appears in Mercer's reports.

**Active Members:** The second phase of the data analysis was to verify that the edited data used by Mercer reflected the raw data supplied by the Systems. For the active groups, we were able to create and compare distributions of participants by age, earnings, and credited service with the active data summaries that appear in Mercer's report. Based on these comparisons, we believe that the active data used by Mercer is consistent with the data supplied by TRS and PERS.

**In-Pay Status:** For the in-pay-status group consisting of service retirees, surviving beneficiaries, and disabilities, we were able to compare average age at commencement, average age at the valuation date, and average monthly benefit amount. For the most part, the Mercer edited data, as summarized in the report, is consistent with the raw data supplied by TRS and PERS.

**Vested Terminated:** The vested terminated participant group was summarized by average age at valuation date and average deferred benefit. We were able to match the average age of the vested terminated participants; however, we were unable to match the average benefit.

In determining the average deferred benefit for the vested terminated group it was necessary to perform a calculation of the accrued benefit of each vested terminated participant based on the compensation and service histories provided in the raw data. Our calculation produced lower average monthly benefits than the Mercer average for both Systems. Based on discussions with Mercer, it is our understanding that most of this discrepancy is due to the calculation of a vested terminated employee's accrued service. Mercer calculated service as the elapsed number of years between initial hire date and date of termination. This technique will tend to overstate the service of a part-time employee or an employee with a break in service.

We recommend that Mercer review the process of calculated accrued benefits for vested terminated members. Alternatively, the best approach would be for each System to perform the calculations and put the resulting accrued benefits on the member records.



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#### Section 6

#### Report Validation

##### ***Audit Conclusion***

We believe the basic mathematical computations contained in the two actuarial valuation reports were completed accurately. However, there were some calculations shown in the reports we could not verify. In addition, as outlined in Section 1, there are a number of processing adjustments that will need to be made to the technical aspects of both the TRS and PERS valuations.

##### ***Comments***

We did have difficulty following certain calculations and were not able to verify all mathematical calculations. We recommend that future valuation reports contain more detail regarding the following:

- Amortization of investment return outside the 5% corridor with interest  
*Section 1.1(c); line (5)*
- Outstanding balance of previously deferred amounts outside the corridor  
*Section 1.1(d); line (5)*
- Normal Cost by type of benefit  
*Section 1.3; line (1)*
- Determination of adjustment for Target Unfunded Liability (PERS only)  
*Section 1.3(c); line (1) of Past Service Rate section*
- Application of Actuarial Projections  
*Section 1.5*
- The contribution rates developed in the valuations include an amortization schedule using a projected membership population. Therefore, the recommended contributions do not comply with the parameters permitted for the calculation of the Annual Required Contribution (ARC) under GASB disclosure Statement No. 25. A separate calculation of the ARC is required and it is not shown in the valuation reports. These calculations are not required to be shown in the valuation, but typically are included because the funding calculations and disclosure calculations are so similar. We do not have enough information to validate the GASB calculations.

